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(56) Documents Cited
GB 2264757 A **GB 2262785 A**

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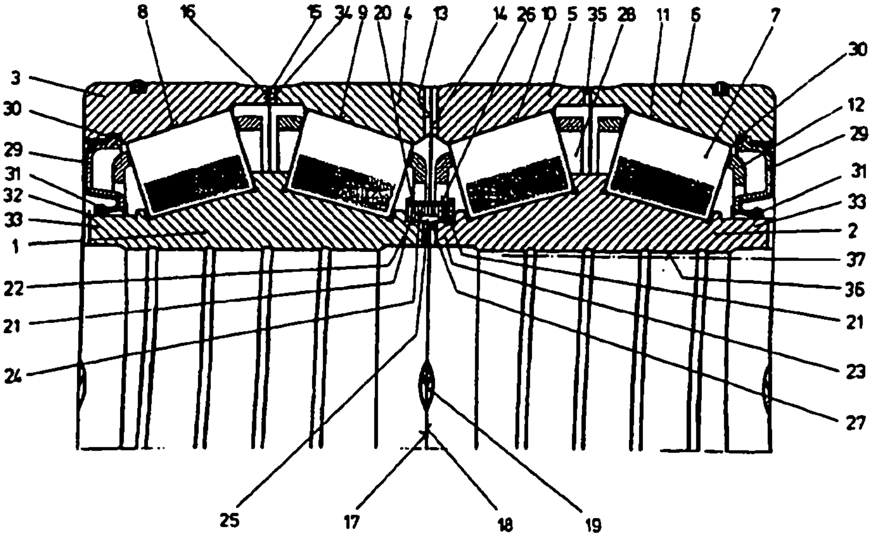
(54) Abstract Title
Four-row taper roller bearing

(57) The invention relates to a four-row taper roller bearing, in particular for use on the work rolls of roll stands. The bearing comprises an inner ring, having a plurality of axially aligned portions 1,2, an outer ring 3-6 and taper rollers 8-11 disposed between the bearing rings. The joint between the mutually facing and abutting end faces 17,18 of the inner ring portions 1,2 is sealed by a sealing ring 20 having a bore, in which bore are provided annular ribs 24 which seat on peripheral surfaces 21 of each of the inner rings. The ribs and the regions of the inner ring peripheral surfaces situated between the ribs define a chamber 25 bridging the joint. At least one of the mutually facing and abutting end faces of the inner rings is provided with substantially radially extending grooves 19, recesses or the like. The chamber 25 and/or the grooves 19 may be supplied with lubricant or with heat conductive inserts. Sealing ring 20 may have a pressure relief valve to relieve excess pressure in bearing cavity 28.



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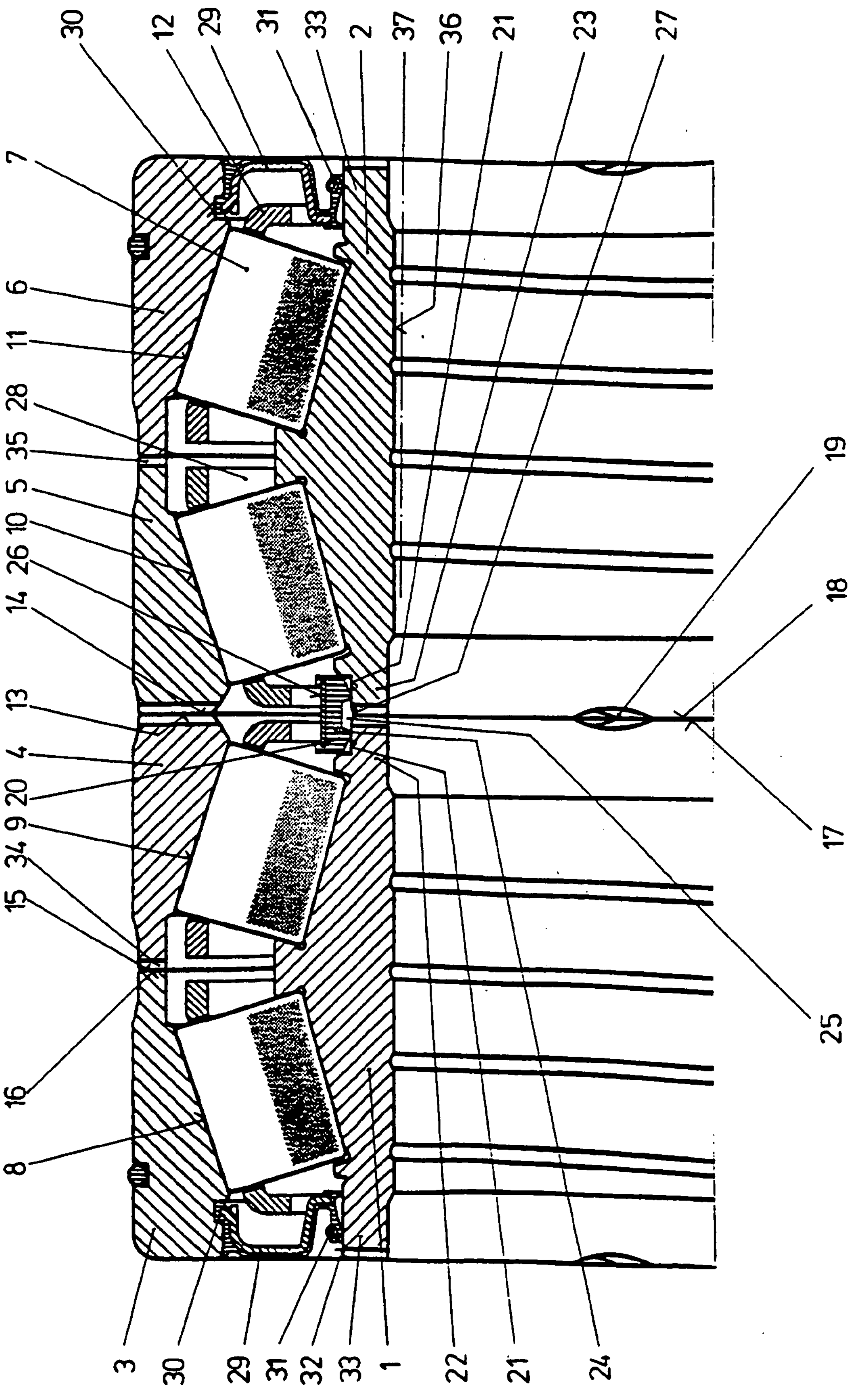

FOUR-ROW TAPER ROLLER BEARING

The invention relates to a four-row taper roller bearing, in particular for use on the work rolls of roll stands.

A four-row taper roller bearing is known, in particular for use on work rolls of roll stands, having an axial multipart inner ring and outer ring and taper rollers disposed between the bearing rings. The joint between the mutually facing and directly adjoining end faces of the inner rings is sealed by a sealing ring which, in its bore, has annular ribs which seat on peripheral surfaces of the inner rings and which between one another and the region of the inner ring peripheral surfaces situated between the ribs form a chamber, bridging the joint, for receiving lubricant (DE-OS 42 06 764).

This known embodiment is only provided for a certain application, for example lubrication under certain operating conditions. This means that for different possible operating conditions a number of variants have to be manufactured and kept in stock. This means increased costs. Moreover, in this known solution the danger arises that wear may occur between the inner ring halves undergoing relative movement relative to one another. Additionally, the heat dissipation from the interior of the bearing is not always sufficient.

Therefore, it is the object of the present invention to design a taper roller bearing of the type described in the introduction in such a way that it can be used universally for any application and in particular for different types of lubrication and which, additionally, ensures low wear and satisfactory heat dissipation.

According to the present invention this object is achieved by providing at least one of the mutually facing and directly adjoining end faces of the inner rings with substantially radially extending grooves, recesses or the like.

In this way, the taper roller bearing according to the invention can be used in a versatile manner. The heat generated in the bearing can be dissipated via the grooves, recesses or the like in the mutually facing end faces of the inner ring halves. This effect can be enhanced, according to another feature of the invention, by inserts of a material having very good thermal conductivity.

Furthermore, the grooves, recesses or the like can serve for the passage or additional storage of lubricant which can be used to lubricate the end faces of the inner ring halves carrying out relative movements in operation. According to further features it is possible to use as lubricant a suitable grease or an oil or solid lubricant stored in a pad of porous material.

The lubricant can also be introduced into the chamber, which is formed by the sealing ring bridging the joint.

This sealing ring prevents abraded particles or other impurities resulting from the relative movement between the inner ring halves, towards one another or with respect to the roll journal, from entering the interior of the bearing.

According to a further feature, the sealing ring can be provided with a valve which opens when there is excess pressure in the bearing interior so that the grooves, recesses or the like can serve as vent and pressure-equalising bores. This is so that, on the one hand, additional heating up of the bearing is avoided and, on the other hand, the lubricant escaping under excess pressure provides a lubricating film between the two adjoining end faces of the inner ring halves and between the bore of the inner ring halves and the roll journal when the bearing is loosely seated on the bearing journal, thereby reducing wear.

One embodiment of the present invention is illustrated by way of example in the accompanying drawings.

The single Figure illustrates a sealed four-row taper roller bearing which is used on work roll bearings for roll stands, predominantly for hot and cold rolling mills. The taper roller bearing according to the invention comprises two inner ring portions 1,2, four outer ring portions 3,4,5,6 and taper rollers 7 disposed in a plurality (four) of rows 8,9,10,11. The taper rollers 7 of each row of rollers 8,9,10,11 are retained and guided in a cage 12 and are disposed between the raceways of the inner rings 1,2 and those of the outer ring parts 3,4,5,6. The inboard outer ring parts 4,5 directly adjoin one another with their mutually facing end faces 13,14, whereas the end faces 15 of the inboard outer ring parts 4,5 are remote from one another and are arranged to abut the end faces 16 of the outboard outer ring parts 3,6. The inner ring portions 1,2 are also arranged directly abutting one another with mutually facing end faces 17,18.

Circumferentially spaced radial grooves 19 are provided in the mutually facing end faces 17,18. The sealing of the joint between the end faces 17,18 of the inner rings 1,2 is effected by a sealing ring 20, for example of rubber or plastics material, which is arranged and centered in the bearing centre on cylindrical peripheral surfaces 21 of inner ring extensions 22,23. For this purpose the sealing ring 20 is provided in the bore with annular ribs 24 which seat on the peripheral cylindrical surfaces 21 of the inner ring 1,2 to form sealed chambers 25 with the inner rings 1,2. The sealing ring 20 is provided with an integral end ring 26, which may be of metal. The inner ring extensions 22,23 have bevelled portions 27 on the mutually facing sides so that when the bearing is being assembled the sealing ring 20 can be pushed on to one inner ring extension 22 and centered thereon, and the inner ring extension 23 of the other inner ring 1 can then be readily inserted into the bore of the sealing ring 20.

The bearing chamber 28 is sealed outwardly by sealing rings 29 which are disposed in annular grooves 30 in the bore of the outer ring parts 3,6 and run with sealing lips 31 on cylindrical circumferential surfaces 32 of inner ring extensions 33. For relubrication and for venting the bearing, the outer ring parts 4,5 can also be provided with corresponding openings 34,35 instead of, or in addition to, the radial grooves 19 of the inner rings.

Lubricant is introduced into the radial grooves 19 and/or the chamber 25. On the one hand, the lubricant lubricates the inner ring end faces 17,18 rotating relative to one another in operation and/or the gap between the bores 36 of the inner ring parts 1,2 and the roll journal 37 (not shown in further detail). On the other hand, the lubricant reliably seals off the bearing chamber 28 from the roll journal 37. Any abraded particles from the roll journal 37 or from the inner ring end faces 17,18 can also be received and collected in these grooves 19 and the chambers 25.

In a known manner, the lubricant can be a grease, an oil (designated solid oil) stored in a pad of porous material, such as a plastics material, or it may be a solid lubricant.

The sealing ring 20 sealing the bearing chamber 28 can be provided with a pressure-relief valve or the like which opens at a given excess pressure when the bearing chamber 28 is being lubricated with oil/air or oil mist and thus vents the bearing chamber 28 and equalises the pressure. Oil can then be entrained into the chamber 25 and the grooves 19, which can serve to lubricate the end faces 17,18 and/or the gap between inner ring bores 36 and roll journals 37. In these instances the chamber 25 and the grooves 19 do need to be filled with lubricant.

Instead of, or in addition to, the lubricant, inserts (not shown) of a material having good thermal conductivity can be inserted in the grooves 19 and, optionally, also in the chambers 25. These inserts dissipate the heat from the bearing chamber 28 and from the inner ring parts 1,2 into the roll journals 27.

The invention is not restricted to the example of embodiment illustrated. Modifications to the design of the individual components are readily possible within the scope of the invention.

CLAIMS:

1. A four-row taper roller bearing, in particular for use on work rolls of roll stands, comprising an inner ring having a plurality of axially aligned portions, an outer ring and taper rollers disposed between the bearing rings, in which a joint between mutually facing and abutting end faces of the inner ring portions is sealed by a sealing ring having a bore in which bore are provided annular ribs which seat on peripheral surfaces of each of the inner rings, the ribs and the region of the inner ring peripheral surfaces situated between the ribs defining a chamber bridging the joint to receive lubricant, wherein at least one of the mutually facing and abutting end faces of the inner rings is provided with substantially radially extending grooves, recesses or the like.

2. A four-row taper roller bearing according to Claim 1, wherein lubricant is provided in the grooves, recesses or the like and/or in the chamber.

3. A four-row taper roller bearing according to Claim 2, wherein a pad of porous material saturated with oil is provided in the grooves, recesses or the like and/or in the chamber.

4. A four-row taper roller bearing according to Claim 2, wherein a solid lubricant is provided in the grooves, recesses or the like and/or in the chamber.

5. A four-row taper roller bearing according to any one of Claims 1 to 4, wherein the sealing ring bridging the joint is provided an opening or valve which opens under excess pressure.

6. A four-row taper roller bearing according to any one of Claims 1 to 5, wherein inserts or the like having good thermal conductivity are provided in the grooves, recesses or the like.

7. A four-row taper roller bearing substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

The Patent Office

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Claims searched: 1 to 7
Examiner: Trevor Berry
Date of search: 10 June 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2A (AD20, AD24, AD28, AD36)

Int Cl (Ed.6): F16C

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2264757 A	SKF-corresponds to DE 4206764	1, 2
Y	GB 2262785 A	SKF-note recesses 56	1, 2

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family
A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.